

ATTACHMENT 12

THE SOURCE GROUP , INC.

MATERIAL SAFETY DATA SHEETS

LEAD METAL

MSDS Number: L2347 ---Effective Date: 11/17/99

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575

CAS No.: 7439-92-1

Molecular Weight: 207.19

Chemical Formula: Pb

Product Codes:

J.T. Baker: 2256,2266

Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY

CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

.....
Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)
.....

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.

Ingestion:

POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:

Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.

Eye Contact:

Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.

Chronic Exposure:

Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.

Aggravation of Pre-existing Conditions:

Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give

oxygen. Get medical attention.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse.

Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in *the* pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all

warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For lead, metal and inorganic dusts and fumes, as Pb:

-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m³ (TWA)

For lead, elemental and inorganic compounds, as Pb:

-ACGIH Threshold Limit Value (TLV): 0.05 mg/m³ (TWA), A3 animal carcinogen

ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).

For lead, inorganic:

-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m³ (TWA)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual & Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face high efficiency dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

9. Physical and Chemical Properties

Appearance:

Small, white to blue-gray metallic shot or granules.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

11.34

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1740C (3164F)

Melting Point:

327.5C (622F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

1.77 @ 1000C (1832F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Lead and other smelter emissions are human reproductive hazards. (Chemical Council on Environmental Quality; Chemical Hazards to Human Reproduction, 1981).

Carcinogenicity:

EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Lead (7439-92-1)	No	No	2B

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Lead (7439-92-1)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	Canada NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-SARA 313- List	Chemical Catg.

Lead (7439-92-1)	No	No	Yes	No
-----\Federal, State & International Regulations - Part 2\-----				
Ingredient	CERCLA	-RCRA-	261.33	-TSCA-
Lead (7439-92-1)	10	No	No	No

Chemical Weapons Convention: No TSCA 12(b) : No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Pure / **solid**)

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: No information found.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 1 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
 Do not breathe dust.
 Keep container closed.
 Use only with adequate ventilation.
 Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:



Material Safety Data Sheet

- Click on the product name to go to the Salesfax description sheet.
- Click on the grade to go to the Salesfax typical test data sheet.

Chevron Plus Unleaded Gasoline(only grade)

MSQS : 3205 Revision #: 18 Revision Date: 06/19/98

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

CHEVRON MID-GRADE UNLEADED GASOLINE

PRODUCT NUMBER(S):	CPS201001	CPS201003	CPS201004	CPS201006
	CPS201007	CPS201008	CPS201010	CPS201011
	CPS201018	CPS201021	CPS201031	CPS201032
	CPS201033	CPS201034	CPS201037	CPS201038
	CPS201041	CPS201043	CPS201046	CPS201048
	CPS201208	CPS201210	CPS201211	CPS201212
	CPS201230	CPS201231	CPS201232	CPS201260
	CPS201261	CPS201262	CPS201271	CPS201272
	CPS201273	CPS201280	CPS201281	CPS201282
	CPS201288	CPS201290	CPS201291	CPS201292

SYNONYM: Calco Mid-Grade Unleaded Gasoline
CHEVRON Plus Unleaded Gasoline

COMPANY IDENTIFICATION

Chevron Products Company
575 Market St.
San Francisco, CA 94105-2856

EMERGENCY TELEPHONE NUMBERS

HEALTH (24 hr): (800)231-0623 or
(510)231-0623 (International)
TRANSPORTATION (24 hr): CHEMTREC
18001424-9300 or (703)527-3887
Emergency Information centers
are located in U.S.A.
Int'l collect calls accepted

PRODUCT INFORMATION: MSDS Requests
(800) 689-3998
(510) 242-5357 Technical Information

SPECIAL NOTES: This MSDS applies to: Federal Reformulated Gasoline,
California Reformulated Gasoline, Wintertime Oxygenated Gasoline,
Low RVP Gasoline and Conventional Gasoline.

2. COMPOSITION/INFORMATION ON INGREDIENTS

100.0 % CHEVRON MID-GRADE UNLEADED GASOLINE

CONTAINING COMPONENTS	AMOUNT	LIMIT/QTY	AGENCY /TYPE
GASOLINE (GENERIC)	100.00%	890 mg/m3 1480 mg/m3 2000 mg/m3	ACGIH TWA ACGIH STEL OSHA PEL

POTENTIALLY

INCLUDING

BENZENE

Chemical Name: BENZENE

CAS71432 < 4.90%

0.5 ppm
2.5 ppm
1 ppm
5 ppm
10 LBS

ACGIH TWA
ACGIH STEL
OSHA PEL
OSHA CEILING
CERCLA 302.4 RQ

ETHYL BENZENE

Chemical Name: BENZENE, ETHYL-

CAS100414

100 ppm
125 ppm
100 ppm
1,000 LBS

ACGIH TWA
ACGIH STEL
OSHA PEL
CERCLA 302.4 RQ

XYLENE

Chemical Name: BENZENE, DIMETHYL-

CAS1330207

100 ppm
150 ppm
100 ppm
100 LBS

ACGIH TWA
ACGIH STEL
OSHA PEL
CERCLA 302.4 RQ

TOLUENE

Chemical Name: TOLUENE

CAS108883

50 ppm
200 ppm
300 ppm
1,000 LBS

ACGIH TWA
OSHA PEL
OSHA CEILING
CERCLA 302.4 RQ

N-BUTANE

Chemical Name: N-BUTANE

CAS106978

800 ppm

ACGIH TWA

N-HEPTANE

Chemical Name: N-HEPTANE

CAS142825

400 ppm
500 ppm
500 ppm

ACGIH TWA
ACGIH STEL
OSHA PEL

N-HEXANE

Chemical Name: N-HEXANE

CAS110543

50 ppm
500 ppm
5,000 LBS

ACGIH TWA
OSHA PEL
CERCLA 302.4 RQ

HEXANE ISOMERS (OTHER THAN N)

HEXANES

500 ppm
1000 ppm

ACGIH TWA
ACGIH STEL

PENTANE (ALL ISOMERS)

PENTANES

600 ppm
750 ppm
1000 ppm

ACGIH TWA
ACGIH STEL
OSHA PEL

CYCLOHEXANE

Chemical Name: CYCLOHEXANE

CAS110827

300 ppm
300 ppm

ACGIH TWA
OSHA PEL

1,000 LBS CERCLA 302.4 RQ

METHYLCYCLOHEXANE

Chemical Name: CYCLOHEXANE, METHYL
CAS108872

400 ppm ACGIH TWA
500 ppm OSHA PEL

TRIMETHYLBENZENE

Chemical Name: BENZENE, TRIMETHYL-
CAS25551137

25 ppm ACGIH TWA

2,2,4-TRIMETHYLPENTANE

Chemical Name: 2,2,4-TRIMETHYLPENTANE
CAS540841

1,000 LBS CERCLA 302.4 RQ

CAN CONTAIN

METHYL TERT BUTYL ETHER (MTBE)

Chemical Name: 2-METHOXY-2-METHYL PROPANE
CAS1634044 < 15.00%

40 ppm ACGIH TWA
50 ppm Chevron STEL
1,000 LBS CERCLA 302.4 RQ

ETHYL TERT BUTYL ETHER (ETBE)

Chemical Name: 2-ETHOXY-2-METHYL PROPANE
CAS637923 < 18.00%

NONE NA

TERT-AMYL METHYL ETHER (TAME)

Chemical Name: 2-METHOXY-2-METHYL-BUTANE
CAS994058 < 17.00%

50 ppm Chevron STEL

ETHANOL

Chemical Name: ETHYL ALCOHOL
CAS64175 < 10.00%

1000 ppm ACGIH TWA
1000 ppm OSHA PEL

COMPOSITION COMMENT:

Refer to the OSHA Benzene Standard (29 CFR 1910.1028) and Table 2-2 for detailed training, exposure monitoring, respiratory protection and medical surveillance requirements before using this product.

Motor gasoline is considered a mixture by EPA under the Toxic Substances Control Act (TSCA). The refinery streams used to blend motor gasoline are all on the TSCA Chemical Substances Inventory. The appropriate CAS number for refinery blended motor gasoline is 86290-81-5. The product specifications of motor gasoline sold in your area will depend on applicable Federal and State regulations. Ethyl Alcohol **is only** added in limited specific distribution areas.

3. HAZARDS IDENTIFICATION

***** EMERGENCY OVERVIEW *****

Colorless to yellow liquid

- EXTREMELY FLAMMABLE
- HARMFUL OR FATAL IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE
- VAPOR HARMFUL
- MAY CAUSE EYE AND SKIN IRRITATION

- LONG-TERM EXPOSURE TO VAPOR HAS CAUSED CANCER IN LABORATORY ANIMALS
- KEEP OUT OF REACH OF CHILDREN

IMMEDIATE HEALTH EFFECTS

EYE :

Contact with the eyes causes irritation. Eye contact with the vapors, fumes, or spray mist from this substance could also cause similar signs and symptoms.

SKIN:

Contact with the skin causes irritation. Not expected to be harmful to internal organs if absorbed through the skin. Prolonged or frequently repeated contact may cause the skin to become cracked or dry from the defatting action of this material.

INGESTION:

Because of the low viscosity of this substance, it can directly enter the lungs if it is swallowed (this is called aspiration). This can occur during the act of swallowing or when vomiting the substance. Once in the lungs, the substance is very difficult to remove and can cause severe injury to the lungs and death.

INHALATION:

May be harmful if inhaled. Breathing the vapors at concentrations above the recommended exposure standard can cause central nervous system effects. The vapor or fumes from this material may cause respiratory irritation.

SIGNS AND SYMPTOMS OF EXPOSURE:

Eye damage or irritation: may include pain, tearing, reddening, swelling, and impaired vision. Skin injury: may include pain, discoloration, swelling, and blistering. Respiratory irritation: may include coughing and difficulty breathing. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

CARCINOGENICITY:

Risk depends on duration and level of exposure. See Section 11 for additional information. Gasoline has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains chemical(s) known to the State of California to cause cancer. Contains benzene, which has been classified as a carcinogen by the National Toxicology Program (NTP), and a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Whole gasoline exhaust was reviewed by the International Agency for Research on Cancer (IARC) in their Monograph Volume 46 (1989). Evidence for causing cancer was considered inadequate in animals and inadequate in humans. IARC placed whole gasoline exhaust in Category 2B, considering it possibly carcinogenic to humans.

4. FIRST AID MEASURES

EYE :

Flush eyes with water immediately while holding the eyelids open. Remove contact lenses, if worn, after initial flushing, and continue flushing for at least 15 minutes. Get medical attention if irritation persists.

SKIN:

Wash skin immediately with soap and water and remove contaminated clothing and shoes. Get medical attention if irritation persists. Discard contaminated clothing and shoes or thoroughly clean before reuse.

INGESTION:

If swallowed, give water or milk to drink and telephone for medical advice. DO NOT make person vomit unless directed to do so by medical personnel. If medical advice cannot be obtained, then take the person and product container to the nearest medical emergency treatment center or hospital.

INHALATION:

Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.

NOTE TO PHYSICIANS:

Ingestion of this product or subsequent vomiting can result in aspiration of light hydrocarbon liquid which can cause pneumonitis.

5. FIRE FIGHTING MEASURES

FIRE CLASSIFICATION:

OSHA Classification (29 CFR 1910.1200): Flammable liquid. See section 7 for appropriate handling and storage conditions.

FLAMMABLE PROPERTIES:

FLASH POINT: (TCC) < -49F (<-45C)

AUTOIGNITION: NDA

FLAMMABILITY LIMITS (% by volume in air): Lower: 1.4 Upper: 7.6

EXTINGUISHING MEDIA:

Dry Chemical, CO2, AFFF Foam or alcohol resistant foam if >15% volume polar solvents [oxygenates).

NFPA RATINGS: Health 1; Flammability 3; Reactivity 0.

FIRE FIGHTING INSTRUCTIONS:

Use water spray to cool fire-exposed containers and to protect personnel. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

COMBUSTION PRODUCTS:

Normal combustion forms carbon dioxide and water vapor; incomplete combustion can produce carbon monoxide.

6. ACCIDENTAL RELEASE MEASURES

CHEMTREC EMERGENCY NUMBER (24 hr): (800)424-9300 or (703)527-3887

International Collect Calls Accepted

ACCIDENTAL RELEASE MEASURES:

Eliminate all sources of ignition in the vicinity of the spill or released vapor.

Stop the source of the leak or release. Clean up releases as soon as possible, observing precautions in Exposure Controls/Personal Protection. Contain liquid to prevent further contamination of soil, surface water or groundwater. Clean up small spills using appropriate techniques such as sorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Follow prescribed procedures for reporting and responding to larger releases. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations. Contact local environmental or health authorities for approved disposal of this material.

Release of this product should be prevented from contaminating soil and water and from entering drainage and sewer systems. U.S.A. regulations require reporting spills of this material that could reach any surface waters. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.

7. HANDLING AND STORAGE

This product presents an extreme fire hazard. Liquid very quickly evaporates, even at low temperatures, and forms vapor (fumes) which can catch fire and burn with explosive violence. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches.

Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, review all operations which have the potential of generating an accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents" and/or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity.

Improper filling of portable gasoline containers creates danger of fire. Only dispense gasoline into approved and properly labeled gasoline containers. Always place portable containers on the ground. Be sure pump nozzle is in contact with the container while filling. Do not use a nozzle's lock-open device. Do not fill portable containers that are inside a vehicle or truck/trailer bed.

Never siphon gasoline by mouth. Use only as a motor fuel. Do not use for cleaning, pressure appliance fuel, or any other such use. DO NOT USE OR STORE near heat, sparks or open flames. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use. READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL.

Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner, or properly disposed of.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:

Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION:

No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.

; SKIN PROTECTION:

No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances. Suggested materials for protective gloves include: <Nitrile> <Polyurethane> <Viton> <Chlorinated Polyethylene (or Chlorosulfonated Polyethylene or CPE)>

RESPIRATORY PROTECTION:

Determine if airborne concentrations are below the recommended exposure limits. If not, wear a NIOSH approved respirator that provides adequate protection from measured concentrations of this material. Use the following element(s) for air-purifying respirators: Organic Vapor. Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DESCRIPTION:

Colorless to yellow liquid

pH: NDA

VAPOR PRESSURE: 5 - 15 PSI @ 100F (REID)

VAPOR DENSITY

(AIR=1): 3-4

BOILING POINT: 25 - 225C

FREEZING POINT: NDA

MELTING POINT: NA

SOLUBILITY: Soluble in hydrocarbons; insoluble in water.

SPECIFIC GRAVITY: 0.7 - 0.8 @ 15.6/15.6C

EVAPORATION RATE: NDA

PERCENT VOLATILE

(VOL): 99+%

10. STABILITY AND REACTIVITY

HAZARDOUS DECOMPOSITION PRODUCTS:

None known

CHEMICAL STABILITY:

Stable.

CONDITIONS TO AVOID:

See section 7.

INCOMPATIBILITY WITH OTHER MATERIALS:

May react with strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

HAZARDOUS POLYMERIZATION:

Polymerization will not occur.

11. TOXICOLOGICAL INFORMATION

EYE EFFECTS:

The mean 24-hour Draize eye irritation score in rabbits is 0.

SKIN EFFECTS:

This material was not a skin sensitizer in the modified Buehler Guinea Pig Sensitization Test. For a 4-hour exposure, the Primary Irritation Index (PII) in rabbits is: 4.8.

ACUTE ORAL EFFECTS:

The oral LD50 in rats is > 5 ml/kg.

ACUTE INHALATION EFFECTS:

No product toxicology data available.

ADDITIONAL TOXICOLOGY INFORMATION:

When vapor exposures are low, or short duration and infrequent, such as during refuelling and tanker loading/unloading, neither total hydrocarbon nor components such as benzene are likely to result in any adverse health effects. In situations such as accidents or spills where exposure to gasoline vapor and liquid is potentially high, attention should be paid to potential toxic effects of specific components in addition to those of total hydrocarbons. Information about specific components in gasoline are found in Section 1 and Section 15 of this MSDS. More detailed information on the health hazard of specific gasoline components can be obtained from the Chevron Emergency Information Center (see Section 1 for telephone numbers).

A study was done in which ten volunteers were exposed for 30 minutes to about 200, 500 or 1000 ppm concentrations of the vapor of three different unleaded gasolines. Irritation of the eyes was the only significant effect observed, based on both subjective and objective assessments.

An inhalation study with rats exposed to 0, 400 and 1600 ppm of wholly vaporized unleaded gasoline, 6 hours per day on day 6 through 16 of gestation, showed no teratogenic effects nor indication of toxicity to either the mother or the fetus (sex ratio, embryotoxicity, fetal growth and development).

An inhalation study with pregnant rats exposed to 0, 1000, 3000, and 9000 ppm of unleaded gasoline vapor, 6 hours per day on days 6 through 20 of gestation, showed no teratogenic effects nor indications of toxicity to either the mother or the fetus.

In an inhalation study, groups of 6 Fischer rats (3 male, 3 female) were exposed to 2056 ppm of wholly vaporized unleaded gasoline for 6 hours per day, 5 days per week for up to 18 months. Histopathology of the peripheral nervous system and spinal cord revealed no distal axonal neuropathy of the type associated with exposure to n-hexane even though gasoline contained 1.9% n-hexane. The authors concluded that gasoline treatment may have amplified the incidence and prominence of some naturally occurring age related changes in the nervous system.

Wholly vaporized unleaded gasoline was used in a 3 month inhalation study. Groups of 40 rats (20 males, 20 female) and 8 squirrel monkeys (4 male, 4 female) were exposed 6 hours per day and 5 days per week for 13 weeks to 384 or 1552 ppm gasoline. One group of each species served as unexposed controls. The initial conclusion of this study was that inhalation of gasoline at airborne concentrations of up to 1522 ppm caused no toxicity in rats or monkeys. However, further histopathological examination of male rat kidneys on the highest dose group revealed an increased incidence and severity of regenerative epithelium and dilated tubules containing proteinaceous deposits.

Rabbits were exposed to unleaded gasoline 24 hours per day, 5 days per week for two weeks; 0, 2.5, 5 or 8 ml were applied to the skin under an occlusive dressing. Applied in such a way, this motor gasoline was corrosive to the rabbit skin and animals in all dose groups had decreased bodyweights. The slight and/or isolated systemic effects noted in the study were judged to be not significant.

Unleaded gasoline was assayed for mutagenic and cytogenetic activity. Gasoline was not mutagenic, either with or without activation, in Ames assay (*Salmonella typhimurium*), *Saccharomyces cerevisiae*, or mouse lymphoma assays. In addition, point mutations were not induced in human lymphocytes exposed to gasoline in vivo. The gasoline was not mutagenic when tested in the mouse dominant lethal assay. Administration of gasoline to rats did not cause chromosomal aberrations in their bone

marrow cells.

In a lifetime skin painting study, 50 male Swiss mice were treated with 0.05 ml of unleaded gasoline three times per week. Positive control groups were treated with benzo(a)pyrene in acetone; an untreated negative control group was also included. The repeated exposure to gasoline caused severe skin irritation, ulceration, hyperkeratosis and abscesses. There was no statistically significant increase in the incidence of skin tumors. Histopathology at the end of the study showed that unleaded gasoline did not increase the incidence of tumors in other organs.

Lifetime inhalation of wholly vaporized unleaded gasoline at 2056 ppm has caused increased liver tumors in female mice. The mechanism of this response is still being investigated but is thought to be an epigenetic process unique to the female mouse. This exposure also caused kidney damage and eventually kidney cancer in male rats. No other animal model studied has shown these adverse kidney effects and there is no physiological reason to believe that they would occur in man. EPA has concluded that the mechanism by which wholly vaporized unleaded gasoline causes kidney damage is unique to the male rat. The response in that species (kidney damage and cancer) should not be used in human risk assessment.

In their 1988 review of carcinogenic risk from gasoline, The International Agency for Research on Cancer (IARC) noted that, because published epidemiology studies did not include any exposure data, only occupations where gasoline exposure may have occurred were reviewed. These included gasoline service station attendants and automobile mechanics. IARC also noted that there was no opportunity to separate effects of combustion products from those of gasoline itself. Although IARC allocated gasoline a final overall classification of Group 2B, i.e. possibly carcinogenic to humans, this was based on limited evidence in experimental animals plus supporting evidence including the presence in gasoline of benzene and 1,3-butadiene. The actual evidence for carcinogenicity in humans was considered inadequate.

To explore the health effects of workers potentially exposed to gasoline vapors in the marketing and distribution sectors of the petroleum industry, the American Petroleum Institute sponsored a cohort mortality, a nested case-control, and an exposure assessment study. Histories of exposure to gasoline were reconstructed for a cohort of more than 18,000 employees from four companies for the time period between 1946 and 1985. Data were analyzed based on length of employment, length of exposure, job category, age at first exposure and estimated cumulative and peak exposures. Cumulative exposure was defined as the sum of products of TWA exposure and duration of exposure of each job in an employee's work history. Among cohort members, cumulative exposure ranged from 2 to 8,000 ppm-years. In general, long-term drivers at small terminals had the highest exposures, and short-term workers with "other terminal jobs" had the lowest. A peak exposure was defined as an episode in excess of 500 ppm lasting 15 to 90 minutes.

The results of the cohort study indicated that there was no increased mortality from either kidney cancer or leukemia among marketing and marine distribution employees who were exposed to gasoline in the petroleum industry, when compared to the general population. More importantly, based on internal comparisons, there was no association between mortality from kidney cancer or leukemia and various indices of gasoline exposure.

For acute myeloid leukemia (AML), a non-significant mortality increase was found in land-based terminal employees, but no trend was detected when the data were analyzed by various gasoline exposure indices. This non-significant excess was limited to land-based terminal employees hired prior to 1948. On the other hand, a deficit of mortality from AML was observed among marine employees.

In addition to the cohort study, a subsequent nested case-control study was also conducted. Four diseases were selected for analysis in the case-control study: Leukemia (all cell types), AML, kidney cancer and multiple myeloma. For each case, five individually matched controls were randomly selected from the cohort. In the original cohort study, broad generic job categories were used as part of exposure assessment. In the case-control study, a finer and more homogeneous job classification was developed. In addition to job category, several quantitative gasoline exposure indices were used in the case-control analysis: length of exposure, cumulative exposure (ppm-years in terms of total hydrocarbons) and frequency of peak exposure. Time period of first exposure to gasoline (1948 or before and 1949 or after) was also included as an exposure index. Results of the nested case-control study confirmed the findings of the original cohort study. That is, exposure to gasoline at the levels experienced by this cohort of distribution workers is not a significant risk factor for leukemia (all cell types), acute myeloid leukemia, kidney cancer or multiple myeloma.

12. ECOLOGICAL INFORMATION

ECOTOXICITY:

Gasoline studies have been conducted in the laboratory under a variety of test conditions with a range of fish and invertebrate species. An even more extensive database is available on the aquatic toxicity of individual aromatic constituents. The majority of published studies do not identify the type of gasoline evaluated, or even provide distinguishing characteristics such as aromatic content or presence of lead alkyls. As a result, comparison of results among studies using open and closed vessels, different ages and species of test animals and different gasoline types, is difficult.

The bulk of the available literature on gasoline relates to the environmental impact of monoaromatic (BTEX) and diaromatic (naphthalene, methylnaphthalenes) constituents. In general, non-oxygenated gasoline exhibits some short-term toxicity to freshwater and marine organisms, especially under closed vessel or flow-through exposure conditions in the laboratory. The components which are the most prominent in the water soluble fraction and cause aquatic toxicity, are also highly volatile and can be readily biodegraded by microorganisms.

The 36-hour LC50 in rainbow trout (*Oncorhynchus mykiss*) is 2.7 mg/l (BTEX). The 48-hour LC50 in daphnia (*Daphnia magna*) is 3.0 mg/l (BTEX). The 96-hour LC50 in sheepshead minnow (*Cyprinodon variegatus*) is 8.3 mg/l (BTEX). The 96-hour LC50 in mysid shrimp (*Mysidopsis bahia*) is 1.8 mg/l (BTEX).

ENVIRONMENTAL FATE:

Following spillage, the more volatile components of gasoline will be rapidly lost, with concurrent dissolution of these and other constituents into the water. Factors such as local environmental conditions (temperature, wind, mixing or wave action, soil type, etc), photo-oxidation, biodegradation and adsorption onto suspended sediments, can contribute to the weathering of spilled gasoline. The aqueous solubility of non-oxygenated unleaded gasoline, based on analysis of benzene, toluene, ethylbenzene+xylenes and naphthalene, is reported to be 112 mg/l. Solubility data on individual gasoline constituents also available.

13. DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible.

This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by USEPA under RCRA (40CFR261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

14. TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT SHIPPING NAME: GASOLINE
DOT HAZARD CLASS: 3 (FLAMMABLE LIQUID)
DOT IDENTIFICATION NUMBER: UN1203
DOT PACKING GROUP: II

15. REGULATORY INFORMATION

SARA 311 CATEGORIES:

1. Immediate (Acute) Health Effects:	YES
2. Delayed (Chronic) Health Effects:	YES
3. Fire Hazard:	YES
4. Sudden Release of Pressure Hazard:	NO
5. Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01=SARA 313	11=NJ RTK	22=TSCA Sect 5(a)(2)
02=MASS RTK	12=CERCLA 302.4	23=TSCA Sect 6
03=NTP Carcinogen	13=MN RTK	24=TSCA Sect 12(b)
04=CA Prop 65-Carcin	14=ACGIH TWA	25=TSCA Sect 8(a)
05=CA Prop 65-Repro Tox	15=ACGIH STEL	26=TSCA Sect 8(d)
06=IARC Group 1	16=ACGIH Calc TLV	27=TSCA Sect 4(a)
07=IARC Group 2A	17=OSHA PEL	28=Canadian WHMIS
08=IARC Group 2B	18=DOT Marine Pollutant	29=OSHA CEILING
09=SARA 302/304	19=Chevron TWA	30=Chevron STEL
10=PA RTK	20=EPA Carcinogen	

The following components of this material are found on the regulatory lists indicated.

BENZENE, ETHYL-
is found on lists: 01,02,03,10,11,12,13,14,15,17,26,28,
N-BUTANE
is found on lists: 02,10,11,13,14,28,
CYCLOHEXANE, METHYL
is found on lists: 02,10,11,13,14,17,26,28,
TOLUENE
is found on lists: 01,02,05,10,11,12,13,14,17,26,28,29,
N-HEXANE
is found on lists: 01,02,10,11,12,13,14,17,27,28,
CYCLOHEXANE
is found on lists: 01,02,10,11,12,13,14,17,26,28,
BENZENE, DIMETHYL-
is found on lists: 01,02,10,11,12,13,14,15,17,
N-HEPTANE
is found on lists: 02,10,11,13,14,15,17,26,28,

2-METHOXY-2-METHYL PROPANE

is found on lists: 01,02,10,11,12,14,24,26,27,30,

BENZENE, TRIMETHYL-

is found on lists: 02,10,11,13,14,26,28,

2,2,4-TRIMETHYLPENTANE

is found on lists: 02,10,11,12,26,

2-ETROXY-2-METHYL PROPANE

is found on lists: 25,26,

ETHYL ALCOHOL

is found on lists: 02,10,11,13,14,17,28,

BENZENE

is found on lists: 01,02,03,04,06,10,11,12,13,14,15,17,20,28,29,

2-METHOXY-2-METHYL-BUTANE

is found on lists: 24,25,26,27,30,

GASOLINE (GENERIC)

is found on lists: 04,08,14,15,17,

PENTANES

is found on lists: 14,15,17,

HEXANES

is found on lists: 14,15,

WHMIS CLASSIFICATION:

Class B, Division 2: Flammable Liquids

Class D, Division 2, Subdivision A: Very Toxic Material

-Carcinogenicity

Class D, Division 2, Subdivision B: Toxic Material

-Skin or Eye Irritation

16. OTHER INFORMATION

NFPA RATINGS: Health 1; Flammability 3; Reactivity 0;

HMIS RATINGS: Health 1; Flammability 3; Reactivity 0;

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines *or* published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT:

This revision updates Section 1 (CPS numbers added).

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	TPQ - Threshold Planning Quantity
RQ - Reportable Quantity	PEL - Permissible Exposure Limit
C - Ceiling Limit	CAS - Chemical Abstract Service Number
A1-5 - Appendix A Categories	() - Change Has Been Proposed
NDA - No Data Available	NA - Not Applicable

Prepared according to the OSHA Hazard Communication Standard

(29 CFR 1910.1200) and the ANSI MSDS Standard (2400.1) by the Toxicology and Health Risk Assessment Unit, CRTC, P.O. Box 1627, Richmond, CA 94804

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond **our** control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modification of the information, we do not assume any responsibility for the results of its use. This information is furnished upon

condition that the person receiving it shall make his own determination
of the suitability of the material *for* his particular purpose.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs

September 1996

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl'i-sī'klīk ār'ə-māt'īk hī'drə-kar'bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are *manufactured*. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- ☐ PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- ☐ PAHs can occur in air attached to dust particles.
- ☐ Some PAH particles can readily evaporate into the air from soil or surface waters.
- ☐ PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.

- ☐ PAHs enter water through discharges from industrial and wastewater treatment plants.
- ☐ Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- ☐ Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- ☐ In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- ☐ PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- ☐ Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smoke-houses; and municipal trash incineration facilities.
- ☐ Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- ☐ Coming in contact with air, water, or soil near hazardous waste sites.
- ☐ Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- ☐ Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>

- 3 Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any

health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-639-6359, ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.





CHLORINATED DIBENZO-p-DIOXINS (CDDs)

Agency for Toxic Substances and Disease Registry ToxFAQs

February 1999

This fact sheet answers the most frequently asked health questions (FAQs) about chlorinated dibenzo-p-dioxins (CDDs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chlorinated dibenzo-p-dioxins (CDDs) (75 chemicals) occurs mainly from eating food that contains the chemicals. One chemical in this group, 2,3,7,8-tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD, has been shown to be very toxic in animal studies. It causes effects on the skin and may cause cancer in people. This chemical has been found in at least 91 of 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are CDDs?

CDDs are a family of 75 chemically related compounds commonly known as chlorinated dioxins. One of these compounds is called 2,3,7,8-TCDD. It is one of the most toxic of the CDDs and is the one most studied.

In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

CDDs are not intentionally manufactured by industry except for research purposes. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

What happens to CDDs when they enter the environment?

- ☐ When released into the air, some CDDs may be transported long distances, even around the globe.

- ☐ When released in waste waters, some CDDs are broken down by sunlight, some evaporate to air, but most attach to soil and settle to the bottom sediment in water.
- ☐ CDD concentrations may build up in the food chain, resulting in measurable levels in animals.

How might I be exposed to CDDs?

- ☐ Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.
- ☐ Breathing low levels in air and drinking low levels in water.
- ☐ Skin contact with certain pesticides and herbicides.
- ☐ Living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs.
- ☐ Working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

How can CDDs affect my health?

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, dis-

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coloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. Some animal species exposed to CDDs during pregnancy had miscarriages and the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immuneresponses.

How likely are CDDs to cause cancer?

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD.

The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen.

The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer.

How can CDDs affect children?

Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. We don't know if CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

How can families reduce the risk of exposure to CDDs?

- ☐ Children should avoid playing in soils near uncontrolled hazardous waste sites.
- ☐ Discourage children from eating dirt or putting toys or other objects in their mouths.
- ☐ Everyone should wash hands frequently if playing or working near uncontrolled hazardous waste sites.
- ☐ For new mothers and young children, restrict eating foods from the proximity of uncontrolled sites with known CDDs.

Is there a medical test to show whether I've been exposed to CDDs?

Tests are available to measure CDD levels in body fat, blood, and breast milk, but these tests are not routinely available. Most people have low levels of CDDs in their body fat and blood, and levels considerably above these levels indicate past exposure to above-normal levels of 2,3,7,8-TCDD. Although CDDs stay in body fat for a long time, tests cannot be used to determine when exposure occurred.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.00003 micrograms of 2,3,7,8-TCDD per liter of drinking water (0.00003 µg/L). Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA. The Food and Drug Administration (FDA) recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (50 ppt).

Source of Information

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological profile for chlorinated dibenzo-p-dioxins. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-639-6359. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.



Abstract

Numerous fire-related incidents involving electrical equipment containing polychlorinated biphenyls (PCB's) have resulted in widespread contamination of buildings with PCB's and, in some cases, with polychlorinated dibenzofurans (PCDF's) and polychlorinated dibenzo-p-dioxins (PCDD's), including 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Emergency response personnel, maintenance or cleanup workers, or building occupants may be exposed to the compounds by inhalation, ingestion, or skin contact.

In experimental animal studies, exposure to PCB's, PCDF's, or PCDD's has resulted in various effects, including decreased body weights, hepatic lesions, thymic atrophy, and adverse reproductive effects, at a wide range of exposure concentrations. In addition, PCB's and TCDD have been shown to be carcinogenic in rats and mice. Humans exposed to PCB's, PCDF's, or PCDD's have developed chloracne, gastrointestinal disturbances, elevated serum enzyme and triglyceride levels, and numbness of the extremities. Epidemiologic studies of humans exposed to PCB's or PCDD's including TCDD are suggestive of an association between exposure to these compounds and increased incidences of cancer.

Based on existing evidence, the National Institute for Occupational Safety and Health (NIOSH) continues to recommend that PCB's and TCDD be regarded as potential human carcinogens in the workplace. Existing evidence also suggests that PCDF's may pose a risk to human health. Therefore, NIOSH recommends that occupational exposure to PCB's, PCDF's, and PCDD's resulting from electrical equipment fires or failures be controlled to the lowest feasible limit, and that workers involved in decontamination activities use all necessary protective measures to prevent exposure.

Background

Physical and Chemical Properties of Polychlorinated Biphenyls (PCB's)

Polychlorinated biphenyls (PCB's)* comprise a class of nonpolar chlorinated hydrocarbons with a biphenyl nucleus in which any or all of the hydrogen atoms have been replaced by chlorine.¹ Commercial PCB's are mixtures of isomers of chlorinated biphenyls exhibiting varying degrees of chlorination. Although there are 209 possible positional chlorobiphenyl isomers, only 100 individual isomers are likely to occur at significant concentrations in commercial PCB mixtures.²

In pure form, the individual chlorobiphenyl isomers are colorless crystals, but the commercial mixtures are liquid due to depression of the melting points through interaction of the individual isomers.³ The physical and chemical

properties of the individual isomers vary widely according to the degree and to the position of chlorination. The PCB compounds have low solubilities in water (0.007 to 5.9 milligrams per liter)³ and low vapor pressures (10⁻⁶ to 10⁻³ millimeters. of mercury at 20°C).¹ PCB's are soluble in most of the common organic solvents, oils, and fats. The compounds are stable to acids and alkali and are resistant to oxidation but are subject to photodechlorination when exposed to sunlight (spectral region above 290 nanometers).¹

Use of PCB's in Electrical Equipment

Commercial products containing PCB's were widely distributed between 1957 and 1977, when large quantities of PCB's were manufactured in the United States and marketed under the trade name Aroclor. The Aroclor products were designated by numbers such as 1221, 1242, 1248, 1254, and 1260, with the last two digits representing the approximate percent by weight of chlorine in the mixtures. Aroclor 1016, however, contained 41% chlorine.¹

Properties of PCB's such as thermal stability, nonflammability, and dielectric capability resulted in their use in electrical capacitors and transformers. Electrical capacitors (small and large) contained nearly 100% PCB's.⁴ Small capacitors containing 0.1-0.6 pound of PCB's were commonly used in household appliances such as television sets, air conditioners, and fluorescent light fixtures, and have been estimated to have service lives of at least 10 years.⁵ Based on Environmental Protection Agency (EPA) estimates that 10% of the small PCB capacitors (<3 pounds of dielectric fluid) are removed from service annually,⁴ approximately 350 million of the capacitors were still in use in 1984. Large capacitors, with a PCB content of more than 3 pounds, have been used in electrical substations, within buildings, and on utility poles. The latest available information indicates that there were approximately 3.3 million large PCB capacitors in service in 1981.⁴

In transformers containing PCB'S, the dielectric fluid generally consists of 60-70% PCB's⁴ and up to 40% chlorinated benzenes.⁶ Trade names of PCB askarels (the generic term used to refer to a broad class of nonflammable, synthetic, chlorinated hydrocarbon insulating liquids) formulated in the United States include Pyranol,[®] Inerteen,[®] and Noflamol,[®]⁷ The volume of fluid in transformers ranges from 40 to 1,500 gallons.⁸ PCB transformers have been used mainly in or near buildings where the proximity of electrical equipment to people and/or property warranted the use of a fire-resistant dielectric fluid. According to EPA estimates, at the end of 1984 there were approximately 107,000 PCB transformers in use or in storage for reuse,⁹ including approximately 77,600 PCB transformers used in or near commercial buildings (e.g., office buildings, shopping centers, hospitals, and schools).¹⁰

In 1976, the United States Congress enacted the Toxic Substances Control Act (TSCA) (Public Law 94-469), which gave the EPA authority to control the production and use of chemicals in the United States. Under Section 6(e) of TSCA the manufacture, processing, distribution in commerce, and use of PCB's after January 1, 1978 was prohibited; however, the EPA may, by rule, allow a particular use of PCB's to continue. In 1982, the EPA issued a final rule on the use of PCB's in electrical equipment. This rule permits the use of certain electrical equipment containing PCB's (e.g., small capacitors, large capacitors, and transformers) to continue under specified conditions for their remaining useful service lives.⁴ In 1985, the EPA issued a final rule on the use of PCB's in electrical transformers. The use of high secondary voltage network PCB transformers in or near commercial buildings (approximately 7,400 transformers) after October 1, 1990, is prohibited. Low secondary voltage network and high secondary voltage radial PCB transformers in or near commercial buildings (approximately 70,200 transformers) must be equipped with enhanced electrical protection devices by October 1, 1990, to avoid overheating from sustained electrical faults.¹⁰

Potential for Exposure to PCB's and Related Compounds Following Electrical Equipment Fire or Failure

Fire-related incidents are defined as incidents involving electrical equipment containing PCB's in which sufficient heat from any source causes the release of PCB's from the equipment casing. In soot-producing incidents an actual fire occurs in or near the PCB-containing electrical equipment eventually resulting in exposure of the PCB's to extremely high temperatures and in the formation and distribution of a black, carbonaceous material. PCB's have been identified in soot following numerous electrical equipment fires.¹¹⁻¹⁷ Polychlorinated dibenzofurans (PCDF's)^{11-15,17-20} and polychlorinated dibenzo-p-dioxins (PCDD's)^{12-15,17-20} have also been identified following this type of fire-related incident. Laboratory studies have confirmed that PCDF's and PCDD's are formed from the pyrolysis of PCB's²¹⁻²⁴ or chlorobenzenes²⁵ at temperatures ranging from 500° to 700°C (932° to 1292°F).

In addition to PCDD's and PCDF's, other polychlorinated hydrocarbons have been identified in soot from electrical equipment fires. Polychlorinated biphenylenes,^{13,26} polychlorinated pyrenes,²⁶ and polychlorinated diphenyl ethers¹⁸ have been detected in soot samples collected following capacitor or transformer fires.

Fire-related incidents in which soot is not produced have occurred from the release of PCB's through the pressure relief valves of overheated transformers.²⁷⁻³¹ The pressurized release of hot PCB vapors can entrain considerable quantities of liquid PCB's forming a fine aerosol. Documented safety valve releases of PCB's from transformers demonstrate that the aerosol

can be distributed to areas beyond the transformer vault by convective air currents.^{27,28,30,31} Although PCBs manufactured in the United States contained up to 2 micrograms of PCDFs per gram of PCB's ($\mu\text{g/g}$),³² recent evidence indicates that additional PCDFs may be formed as a result of the sustained high temperatures in non-soot-producing incidents.³¹

Air, soot, and surface values for PCBs, PCDFs, PCDD's, 2,3,7,8-tetrachlorodibenzofuran (TCDF), and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) measured following fire-related incidents in the United States are presented in Table 1.

An example of each type of fire-related incident involving PCB transformers is described in the Appendix.

Exposure Limits

The Occupational Safety and Health Administration (OSHA) promulgated its permissible exposure limits (PEL) of 1 milligram per cubic meter of air (mg/m^3) for chlorodiphenyl products containing 42% chlorine and 0.5 mg/m^3 for chlorodiphenyl products containing 54% chlorine determined as 8-hour time-weighted average (TWA) concentrations³⁵ based on the 1968 Threshold Limit Values (TLVs) of the American Conference of Governmental Industrial Hygienists (ACGIH).³⁶ The TLVs, which have remained unchanged at 1 mg/m^3 (42%) and 0.5 mg/m^3 (54%) through 1985,³⁷ are based on the prevention of liver injury in exposed workers.³⁸ The ACGIH Short Term Exposure Limits (STEL) for chlorodiphenyls are 2 mg/m^3 and 1 mg/m^3 for 42% and 54% chlorine products, respectively. The OSHA PEL and the ACGIH TLV and STEL values include a "Skin" notation which refers to the potential contribution to overall exposure by the cutaneous route, including the mucous membranes and eyes, by either airborne or direct skin contact with PCB's.³⁷

The National Institute for Occupational Safety and Health (NIOSH) recommends that exposure to PCBs in the workplace be limited at or below the minimum reliable detectable concentration of 1 $\mu\text{g/m}^3$ (using the recommended sampling and analytical methods) determined as a TWA for up to a 10-hour workday, 40-hour workweek. The NIOSH recommended exposure limit (REL) was based on the findings of adverse reproductive effects in experimental animals, on the conclusion that PCBs are carcinogens in rats and mice and, therefore, potential human carcinogens in the workplace, and on the conclusion that human and animal studies have not demonstrated a level of exposure to PCB's that will not subject the worker to possible liver injury.³⁹

Toxicity

Results of Animal Studies

Effects of PCB's, PCDF's, and PCDD's

In general, the toxic responses observed in animals treated with PCB's, PCDF's, or PCDD's are similar, but the potencies of individual compounds vary according to the degree and position of chlorination. The tetra-, penta-, and hexa-chlorinated isomer groups exhibit greater toxicity than the other chlorinated forms.⁴⁰⁻⁴² Dibenzofuran and dibenzo-p-dioxin compounds with chlorine at positions 2, 3, 7, and 8 are particularly toxic.⁴³⁻⁴⁵ The lethal doses in milligrams per kilogram of body weight (mg/kg) for 50% (LD₅₀) of the animals tested by the single oral administration of PCB's, TCDF, or TCDD in four animal species are presented in Table 2.

Effects of Soot Containing PCB's, PCDF's, and PCDD's

A composite sample of soot collected following a transformer fire in Binghamton, New York in 1981, contained 5,000 µg PCB's/g, 48 µg TCDF/g, and 1.2 µg TCDD/g. Single oral administration to guinea pigs of the soot in aqueous methylcellulose or of a benzene extract of the soot in the same aqueous vehicle produced LD₅₀ values of 410 and 327 mg/kg, respectively. Single oral administration of TCDD in aqueous methyl cellulose or in corn oil produced LD values of 19 and 2.5 µg/kg, respectively. Animals surviving for 42 days after administration of the soot showed dose-related evidence of decreased weight gain and kidney weight, thymic atrophy, increased serum triglycerides, goblet cell hyperplasia of pancreatic interlobular ducts, and metaplasia of salivary gland interlobular duct epithelium. In rabbits, dermal application of the saline-moistened soot or of a benzene extract of the soot at a dose comparable to 500 mg soot/kg body weight for 24 hours produced hypertrophy of centrilobular hepatocytes in 50% of the rabbits at the end of the 65-day observation period. No signs of overt toxicity were observed in the rabbits, except dermal inflammatory reactions noted in rabbits treated with the soot extract.⁵⁷ The dermal LD₅₀ of TCDD in rabbits is 275 µg/kg,⁴⁷ while the dermal minimum lethal dose of PCB's (as Aroclor 1260) is from 1.26 to 2.00 grams/kg.⁵⁸ Because the measured amounts of TCDF and TCDD in the soot were low, other congeners may have contributed to the toxic effects observed in guinea pigs and rabbits.^{16,57}

In a subchronic toxicity study, the total soot contained in food that was consumed in 90 days by guinea pigs was 1.2, 22, 55, or 275 mg soot/kg body weight. A fifth group of guinea pigs was terminated after 32 days (total consumption of 400 mg soot/kg body weight) because mortality had reached 35%. The intensities of the toxic responses were dose-related,

but no signs of toxicity were detected in guinea pigs with a total consumption of 12 mg soot/kg body weight.⁵⁹

Human Health Effects

Several cases of chloracne, hyperpigmentation, gastrointestinal disturbances, elevated serum enzyme and triglyceride levels, and numbness of the extremities have been reported among people exposed to PCB's^{39,60,61} or PCDD's.^{54,62} Comparative human and animal studies indicate that PCDF's were the main causative agents of similar symptoms reported in individuals who ingested cooking oil Is contaminated with PCB's and PCDF's⁶³

There is suggestive evidence of associations between increased incidences of cancer and exposure to PCB's,⁶⁴ to PCB's containing significant PCDF's,^{65,66} and to phenoxyacetic herbicides contaminated with PCDD's including TCDD.^{67,68} However, definite causal relationships between exposure and carcinogenic effects in humans remain unclear due to the inadequately defined populations studied and the influences of mixed exposures.

The firefighters and other workers involved in the Binghamton transformer fire cleanup have been followed through a medical surveillance program. Medical evaluation of these workers approximately one year after the fire showed slight increases in serum PCB levels but no observable adverse health effects from this exposure.⁶⁹ Selected workers from this study group have been found to have elevated adipose tissue levels of PCDF's and PCDD's⁷⁰ and associated histologic changes in the liver.⁷¹ Further monitoring of this population is in progress.

Recommendations

There are several classifications for identifying a substance as a carcinogen. Such classifications have been developed by the National Toxicology Program (NTP),⁷² the International Agency for Research on Cancer (IARC,⁷³ and OSHA in its "Identification, Classification, and Regulation of Potential Occupational Carcinogens" 29 CFR 1990,⁷⁴ also known as "The OSHA Cancer Policy." NIOSH considers the OSHA classification the most appropriate for use in identifying potential occupational carcinogens."⁷⁴ Because exposure to PCB's or TCDD has been shown to produce malignant tumors in rats and mice, they meet the OSHA criteria. Therefore, NIOSH continues to recommend that PCB's and TCDD be considered as potential human carcinogens in the workplace. Limited evidence from animal and human studies suggests that PCDF's may also pose a risk to human health. As prudent public health policy, NIOSH recommends that occupational exposure to PCB's, PCDF's, and PCDD's resulting from electrical equipment fires or failures be controlled to the lowest feasible limit.

As a result of fire-related incidents involving PCB-containing electrical equipment, emergency response personnel, maintenance and cleanup workers, and building occupants may be at risk of exposure to PCBs, PCDF's, and PCDD's. The following recommendations are intended to minimize worker exposure to these compounds and reflect experiences NIOSH personnel and others have gained in responding to such incidents. These recommendations focus primarily on PCB transformer fires, although many of the recommendations apply to other types of fire-related incidents involving PCBs.

Recognition of Potential Hazard

Emergency response personnel should be informed of the presence of PCB-containing electrical equipment and of the potential health hazards associated with exposure to emissions from such equipment. **All** workers should understand that exposure can occur through inhalation, ingestion, and skin absorption (by direct contact or by contact with contaminated surfaces, clothing, and equipment) and recognize that exposure to some of these compounds may result in long term health effects. Required registration of PCB transformers with local fire departments¹⁰ is intended to assure early recognition of the potential hazards when a fire-related incident occurs. The registration for each transformer should include: building location; location of transformers) within or near the building; transformer serial number, manufacturer, and kilovolt/ampere rating; and total volume and generic composition of the dielectric fluids. This information should be readily accessible to those persons responsible for the health and safety of emergency response personnel and others who may come into contact with PCB transformers.

To assist in the identification of PCB transformers the effective use of signs and labeling should be instituted. While labeling of PCB transformers is required (using the mark "ML"),¹⁰ additional signs and labels should be placed in areas near the location of a PCB transformers). The number of emergency response personnel or cleanup workers entering a potentially contaminated area(s), (e.g., interior of the building or transformer vault) should be limited. This action would minimize the number of workers exposed and would reduce the amount of protective clothing and equipment potentially contaminated.

Assessment of Exposure

Contamination assessment is necessary to determine the extent and relative degrees of contamination of an area following a fire-related incident. NIOSH's Occupational Exposure Sampling Strategy Manual is useful in developing appropriate strategies to monitor worker exposure to PCB's and related pyrolysis products.⁷⁵ Air and surface wipe samples should be

collected in all areas potentially contaminated by the incident. Air sampling should include both the particulate and vapor phase. Wipe samples should be taken on both vertical and horizontal surfaces. Additional samples may include residual fluid in the transformer, fluid deposited in the vault, or soot. Air and surface wipe samples should be analyzed for PCB'S, tetra- through octa-chloro homologs of PCDF and PCDD, and the respective 2,3,7,8-tetrachloro isomers. Detailed descriptions of sampling and analytical techniques for PCB's may be found in the **NIOSH** Manual of Analytical Methods.^{76,77} Sampling procedures and sensitive methods for the analyses of PCDF's and PCDD's have been developed by the New York State Department of Health.^{16,78}

Personal Protective Clothing

All workers who may be exposed to PCB's, PCDF's, and PCDD's should be equipped with chemical protective clothing to ensure their protection. In the selection of protective clothing, consideration should be given to the utilization of disposable apparel because of life uncertainty of decontamination of reusable clothing.

Outer protective garments should consist of a zippered coverall with attached hood and draw string, elastic cuffs, gloves, and closure boots.

If exposure to soot is anticipated, workers should wear outer coveralls made of a nonwoven fabric such as spunbonded Tyvek® to exclude particulates. If exposure to liquids or to both soot and liquids is anticipated, or if the form of the contaminants is unknown, the outer coveralls should be made of chemically resistant materials such as Saranax®-coated Tyvek or Viton®-coated neoprene. Gloves and boots should be made of neoprene, nitrile, butyl rubber, or Viton which have been shown to be resistant to permeation by PCB's.^{70,80} For personal comfort workers may wear inner garments consisting of cotton coveralls, undershirts, undershorts, gloves, and socks. Inner garments should be disposed of after use because small amounts of contaminants may be transferred in removing outer garments.⁷⁹ All disposable clothing should be placed in approved containers and disposed of according to EPA disposal procedures.⁴⁰

Respiratory Protection

The use of respiratory protection for those involved in cleanup operations requires that a respiratory protection program be instituted which, at a minimum, meets the requirements of 29 CFR 1910.134⁸¹ and that the respirators selected be approved by the Mine Safety and Health Administration (MSHA) and by NIOSH. The respiratory protection program should include training of workers regarding the proper use, fit testing, inspection, maintenance, and cleaning of respirators. The program should be evaluated regularly.

Where a risk of exposure to airborne contaminants exists, such as when visible quantities of soot are to be removed, workers should wear a self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. Alternatively, a combination supplied air respirator, with full facepiece, operated in pressure-demand or other positive pressure mode and equipped with auxiliary positive pressure self-contained air supply can be used. When cleanup operations have advanced to a point where airborne PCB's can no longer be detected, air-purifying full facepiece respirators equipped with a high efficiency particulate air filter and organic vapor cartridge should be used, as a precaution, until final decontamination is completed.⁸²

Decontamination and Worker Protection Programs

In general, decontamination procedures must provide an organized process in which the extent and degree of contamination are systematically reduced. This should include procedures that take into account containment, collection, and disposal of contaminated solutions and residues generated during the incident and cleanup. Separate facilities should be provided for decontamination of large equipment. The EPA's Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites provides information for developing a decontamination strategy.⁸³

Each stage of decontamination, such as gross decontamination and repetitive wash/rinse cycles, should be conducted separately, either by using different locations or by spacing in time. Personnel decontamination locations should be physically separated from the contaminated area(s) to prevent cross-contact and should be arranged in order of decreasing level of contamination. Separate entry/exit routes and locations should be well marked and controlled. Access to the decontamination area should be separate from the path between the contaminated and clean areas. Dressing stations for entry should be separate from redressing areas for exit. All reusable clothing and equipment should be grouped according to perceived degree of Contamination (i.e., high, moderate, or low) and thoroughly cleaned. Decisions concerning decontamination end points are often based on the lack of visible contamination; however, the absence of observable surface contamination does not necessarily indicate the absence of contaminants absorbed into the material. Reusable clothing and equipment should, therefore, be analyzed for residual contamination before reuse or storage.

Soot from transformer fires is typically black, friable, carbonaceous material. Preliminary cleanup of the areas visibly contaminated with soot should involve dry vacuuming of both horizontal and vertical surfaces with a vacuum cleaning system equipped with a high efficiency particulate (HEPA) filter.

Final cleanup methods should include washing surfaces with alkaline²⁷ or nonionic⁸⁴ synthetic detergents in water. The addition of a caustic agent, such as trisodium phosphate, may help to remove grease deposits, floor waxes, and furniture polishes. Waxed and polished surfaces tend to absorb contaminants from the air. Cleaning with organic solvents is useful for nonporous electrical and mechanical equipment where contact with water-based cleaning fluids may damage the equipment. Organic solvents, such as kerosene, mineral spirits, and trichlorotrifluoroethane, may carry contaminants deeper into porous materials and should not be used on these surfaces. Complete decontamination of porous surfaces, such as concrete and masonry surfaces in vaults, may not be possible; therefore, application of an elastomeric, abrasion- and flame-resistant sealant may be required.

Post-Decontamination Testing

The adequacy of the decontamination effort should be determined by followup sampling and analysis of the contaminated areas and reusable protective equipment. This testing should be conducted as each area is decontaminated and again after the entire facility has been cleaned. Decontamination guidelines for the cleanup of specific buildings following fires involving PCB transformers^{83,85} have been proposed by the New York State Department of Health,⁸⁶ the New Mexico Expert Advisory Panel,⁸⁷ the California Department of Health Services,⁸⁸ and the San Francisco Department of Health.⁸⁹

PRODUCT NAME: METHANE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER
CHEMTREC (800) 424-9300

TELEPHONE NUMBER (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: METHANE
CHEMICAL NAME: CH₄
COMMON NAMES/SYNONYMS: Methyl Hydride
TDG (Canada) CLASSIFICATION 2.1
WEMIS CLASSIFICATION: A, B1

PREPARED BY Loss Control (908) 464-8100 / (905) 501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA ¹	TLV-ACGIH ²	LD ₅₀ or LC ₅₀ Route/Species
Methane FORMULA: CH ₄ CAS: 74-82-8 RTECS# PA1490000	100	Simple Asphyxiant	Simple Asphyxiant	Not Available

¹ As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

² As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW				
Simple asphyxiant - maintain oxygen levels above 19.5%. Extremely flammable.				

Skin Contact Yes	Skin Absorption NO	Eye Contact Yes	Inhalation Yes	Ingestion No
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PRODUCT NAME: METHANE

Exposure Limits No	Irritant No	Sensitization No
Teratogen No	Reproductive Hazard No	Mutagen No

NFPA HAZARD CODES

Health: 0
Flammability: 4
Reactivity: 0

HMIS HAZARD CODES

Health 0
Flammability: 4
Reactivity: 0

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures**EYES:**

Never introduce ointment or oil into the eyes without medical advice! If pain is present, refer the victim to an ophthalmologist for treatment and follow up.

SKIN

None needed as product is a gas at room temperature

INGESTION

Not normally required.

PRODUCT NAME METHANE

INHALATION

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO THIS PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Victims should be assigned to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive. Keep victim warm and quiet.

Flash point -306°F (-188°C)	Method: Closed cup	Autoignition Temperature: 1076°F (580°C)

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classification:
Class 1, Group D.

Earth ground and bond all lines and equipment associated with the ethylene system. Electrical equipment should be non-sparking or explosion-proof.

Methane is non-corrosive and may be used with any common structural material

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<3000 psig) piping or

MSDS: G-56
Revised: 6/7/96

PRODUCT NAME: METHANE

systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in the storage or use area.

For additional storage recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9, P-14, and Safety Bulletin SB-2.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS¹:

INGREDIENT	% VOLUME	PEL-OSHA ²	TLV-ACGIH ³	LD ₅₀ or LC ₅₀ Route/Species
Methane FORMULA: CH ₄ CAS: 74-82-8 RTECS #: PA1490000	100	Simple Asphyxiant	Simple Asphyxiant	Not Available

¹ Refer to individual state or provincial regulations, as applicable, for limits which may be more stringent than those listed here.

² As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)

³ As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

ENGINEERING CONTROLS:

Hood with forced ventilation. Local exhaust to prevent dilution of oxygen levels below 19.5%. Mechanical in accordance with electrical codes.

EYE/FACE PROTECTION

Safety goggles or glasses.

SKIN PROTECTION

Plastic or rubber gloves, Protective gloves made of any suitable material.

RESPIRATORY PROTECTION

Positive pressure air line with mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:

Safety shoes, safety shower, eyewash "fountain."

PRODUCT NAME: METHANE

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not Available	
Vapor density (<i>Air</i> =1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: -265.7	°F
	: -161.5	°C
Freezing point	: -296.5	°F
	: -182.5	°C
pH	: Not Applicable	
Specific gravity	: 0.55	
Oil/water partition coefficient	: Not Available	
Solubility (H ₂ O)	: Negligible	
Odor threshold	: Not Applicable	
Odor and appearance	: Odorless, colorless gas	

10. Stability and Reactivity

STABILITY:

Stable

INCOMPATIBLE MATERIALS:

Oxidizers

HAZARDOUS POLYMERIZATION

Will not occur.

11. Toxicological information

No data given in the Registry of Toxic Effects of Chemical Substances (RTECS) or Sax, Dangerous Properties of Industrial Materials, 7th ed.

Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

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PARAMETER	United States <i>DOT</i>	<i>Canada</i> TDG
PROPER SHIPPING NAME	Methane, compressed	Methane, compressed
HAZARD CLASS:	2.1	2.1
IDENTIFICATIONNUMBER	UN 1971	UN 1971
SHIPPING LABEL:	FLAMMABLE GAS	FLAMMABLE GAS

15. Regulatory Information

Methane is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:

Acute Health Hazard

Fire Hazard

Sudden Release of Pressure Hazard

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).